

UNITS-V DR.E.NATARAJAN

FISH HARVEST TECHNOLOGY

1. INLAND FISHING CRAFTS AND GEAR 2. HANDLING 3. PROCESSING AND PRESERVATION OF FISH 4. FISHERY BY-PRODUCTS 5. MARKETING AND ECONOMICS.

1. INLAND FISHING CRAFTS AND GEARS IN INDIA

The use of crafts and gears in fishing technology plays very important role and help enhancing the production commercial bases. The success of fishing largely depends on to how and which types of nets are used to capture the fish.

There are two main types of devices used to capture fishes in both marine and inland fisheries:

(1) Nets or gear — these are instruments used for catching fish.

(2) Crafts or Boats — It provides platform for fishing operations, carrying the crew and fishing gears.

There are various types of gears and crafts used in different parts depending upon the nature of water bodies, the age of fish and their species. Some nets are used without craft, however, others are used with the help of crafts. Generally, locally made gears and crafts may be non-mechanized or mechanized.

Fishing Crafts

A. Dingi



- ❖ The crafts are plank built, made up locally using Shisham wood.
- ❖ The dugout canoes were very common in the lake (Suraha Lake, Uttar Pradesh) in earlier days but is rare now.
- ❖ The size of boat varies from 42 – 45 cm in length and 8 - 10 cm in width.
- ❖ The boat preservatives ie. painting with bitumen, act as water-resistant and protect crafts from decay and destruction.
- ❖ It also gives long life to the craft besides making the boat leak proof.
- ❖ Every six months the craft is completely painted by the dammar. The manufacturing cost of the boat is estimated around Rs. 8000-10000 with a life span of 8-10 years.

B. Coracle

- ❖ Coracles are light in weight, bowl shaped boats with a frame of woven grass, reeds, or saplings covered with hides.
- ❖ Over the years, these circular crafts were constructed by interwoven strips of bamboo and covered with water proof materials such as plastic bags coated with a layer of coal tar.
- ❖ The boat size ranges between 1.50 - 2.00 meters dia.
- ❖ The coracle weight ranges between 10 - 15kg. A single oar is used to propel the coracle. Two fishers conduct the fishing in a coracle.
- ❖ Gillnet and long line are the common fishing methods.
- ❖ Apart from being simple and inexpensive, these are durable (2 – 3 years) and have good movability in all water bodies.
- ❖ It is profoundly used in Tamil Nadu, Andhra Pradesh, and Karnataka.



C. Dhoni



- ❖ It is a long dug-out canoe made from carved out basal part of the trunk of a palmyra tree.
- ❖ It is around 3 - 4m length and with an internal diameter of 0.5m.
- ❖ The major portion of the trunk is longitudinally scooped out for sitting and keep the captured fish.
- ❖ Wooden bar is sometimes fixed in the mid region of the scooped out part for sitting and to avoid collapse of the canoe.
- ❖ Margins of the scooped out part is framed by circular iron frames in some canoes to prevent from splitting.
- ❖ It is operated by a single person due to its small size.
- ❖ The narrow width of this gear also facilitates rolling movements, and hence skilled individuals operate these canoes to maneuver it effectively.

D. Plank built boats



- ❖ These are spindle shaped and constructed by joining quality wooden planks with iron nails. Joints are leak proofed by applying coal tar. Small and large sized plank built rowing boats are commonly used in the lakes.
- ❖ The smaller boats are 5 - 6m long with 80 - 90cm beam width and used for transport of harvested fish and also passengers from village to village within the lake.
- ❖ They are non-mechanized and manually operated.
- ❖ Bigger boats are about 15 - 20m long and are mechanized.
- ❖ They are used to transport fish to landing centers.

E. Thermocol raft



- ❖ It is an improvised country made fishing craft made of used thermocol boxes and slices (for fish preservation and transport).
- ❖ The required number of thermocol boxes and slices is tied together with the help of nylon ropes to make a platform of length 4 - 5m length with 1m width.
- ❖ It is commonly operated by children of 10 - 15 years of age for setting and collection of traps, transport of catch and fish capture near the lake shore.

FISHING GEARS

A. Hook and line



- ❖ It is one of the oldest and widely used fishing methods which are not commercially used and fish caught is consumed by fishermen family itself.
- ❖ Catching of fish in which fishes are caught individually is based on feeding and hunting behaviour of fish species.
- ❖ In this technique, fish are caught with the help of baits tied to a metal hook tied with one end of a strong nylon thread and the other end of nylon thread is tied to a bamboo pole of different lengths to dip the metal hook supplied with bait in the water.
- ❖ Earthworms, Grasshoppers, small sized fish and trash fish pieces are commonly used as baits. Attracted to the bait, fish swallow and gets entrapped by the hooks are caught by pulling up the threads. Catfishes and murrel are caught with this technique.

B. Box trap



- ❖ It is a fishing device in which fish are enticed by enclosures where they are guided to enter the trap.
- ❖ It is the chief gear used for fishing in the lake to catch different species and sizes of fish.
- ❖ These are made of split bamboo sticks woven with the long pliable stems of a creeper called Good apala Theega.
- ❖ Catching fish through traps is a passive process. Baits are kept inside the traps sometimes to attract fish.
- ❖ The rectangular shape basket trap is the most extensively operated gear and accounts for major part of the catches.
- ❖ It has two vertical openings, one on each long side.
- ❖ Each vertical opening is fixed with a series of inwardly directed, short, pointed bamboo sticks interwoven in such a way that the tips of the two series of splints cross each other.
- ❖ This type of arrangement only permits easy entry of the fish but not their exit. Three types of basket traps are regularly used in this area.

C. Tubular trap



- ❖ It is funnel like (Gampa) seasonal (October to January) trap made of split bamboo slivers used to catch small and medium size fish.
- ❖ It is about 1 - 2m long with a wide mouth (85cm diameter) at one end and with a narrow opening at another end.
- ❖ The narrow end is attached to a large basket (Gari), narrow and longer than gampa and provided with a valve-like arrangement which allows entry of fish but not exit.

D. Bag net



- ❖ It is a bag like net with framed mouth.

- ❖ It is more or less circular made up of nylon with a mesh size of 2 - 3 mm and depth of a bag is about 0.5 - 1m provided with a circular iron frame and a long handle made with a bamboo pole. This net can be horizontally extended when scooping it through the water column.
- ❖ Fishes entering the bag net are caught due to water filtering.
- ❖ Net is operated in shallow water regions of the lake either from the banks or the dugout canoes by inserting the net inside water below the aquatic weeds or in the weed infested area.
- ❖ This net is also used as a passive gear while fish catching through 'gaya' method.
- ❖ This net can also be used to collect mollusks (Duck feed & fish bait) by dragging or scooping over the bottom of the lake bed.

E. Hand lift net



- ❖ It is a small, portable hand operated net used in the shallow region of the river to catch small sized fish.
- ❖ It is a rectangular shape dip lift net supported by an X-shaped bamboo frame.
- ❖ A frame is made of two flexible bamboo poles of equal lengths.
- ❖ Four corners of the net are tied into four corners of the bamboo frame.
- ❖ This mobile scooping gear is dipped in shallow waters for some time and then lifted up rapidly from water to catch the entrapped fish which happen to be over the net by hand picking.

F. Cast net



The cast net is operated in shallow waters of the lake where depth is about 2 - 3m.

- ❖ It is circular net having umbrella shape made of nylon fibers.
- ❖ The cast net is a falling gear and operation of cast net is an active fish catching process.
- ❖ Iron or lead sinkers are fixed along the margin, and a strong rope of 5 - 6m is attached to the apex of the net to haul the net during its operation.
- ❖ Size of the mesh ranges from 20 - 45mm and perimeter range from 10 - 18m based the size of the fishes to be caught.
- ❖ These nets can be operated single handedly in which fishermen throw the net conveniently and skillfully over the water either from a boat or the banks of the lake in such a way that it spreads on the water surface fully expanded at its perimeter and cord is held in hand at its apex.
- ❖ Net sinks to the bottom of the lake with closed circumference due to the weight provided by sinkers provided.
- ❖ Small fishes such as carps and catfishes caught with these nets then pulled with the help of the cord

G. Drag Net



- ❖ Drag net is used to encircle certain region of the lake to catch a detected fish school by dragging the net or scooping it out with other gears.
- ❖ It is very effective gear to catch the wild fish population and is more suitable for huge water bodies such as lake Kolleru.
- ❖ During its operation, one end is fixed at the bank of the lake, and the other end is to be towed in an arc around the fish shoal to surround them, and a boat or Dhoni is used to pull the net into a large area before its hauling to the bank of the lake.

H. Gill net



- ❖ Gill net is a passive rectangular gear.
- ❖ This net is erected in water column vertically perpendicular to the movement of fish with the help of head and foot ropes provided with sinkers and floats respectively.
- ❖ As fish attempt to swim through the mesh of the net, they become snagged by their gill operculum, fins or by their scales.
- ❖ Small undersized fish usually can swim through the mesh unharmed, whereas excessively large fish are unable to penetrate the mesh sufficiently to become trapped.
- ❖ Characteristics such as simplicity in its operation, design, and construction, low investments attract the fishermen to use it extensively.
- ❖ Nets of smaller size are operated in the shallow regions of the lake depth ranging from 1 - 2m where as large sized ones are relatively used in the deeper areas of the lake at 2 to 4m depth.

-----END-----

2. HANDLING AND TRANSPORT

Handling the catch: When fish are captured or harvested for commercial purposes, they need some preprocessing so they can be delivered to the next part of the marketing chain in a fresh and undamaged condition. This means, for example, that fish caught by a fishing vessel need handling so they can be stored safely until the boat lands the fish on shore.

Typical handling processes are:

- ❖ Transferring the catch from the fishing gear (such as a trawl, net or fishing line) to the fishing vessel
- ❖ Holding the catch before further handling
- ❖ Sorting and grading
- ❖ Bleeding, gutting and washing
- ❖ Chilling
- ❖ Storing the chilled fish
- ❖ Unloading, or landing the fish when the fishing vessel returns to port

Handling live fish:

- ❖ An alternative, and obvious way of keeping fish fresh is to keep them alive until they are delivered to the buyer or ready to be eaten.
- ❖ This is a common practice worldwide.
- ❖ Typically, the fish are placed in a container with clean water, and dead, damaged or sick fish are removed.
- ❖ The **water temperature** is then lowered and the fish are starved to reduce their metabolic rate. This decreases fouling of water with metabolic products (ammonia, nitrite and carbon dioxide) that become toxic and make it difficult for the fish to extract oxygen.
- ❖ Fish can be kept alive in **floating cages, wells and fish ponds**. In aquaculture, holding basins are used where the water is continuously filtered and its temperature and oxygen level are controlled. In China, floating cages are constructed in rivers out of **palm woven baskets**, while in South America simple **fish yards are built** in the backwaters of rivers.

- ❖ Live fish can be transported by methods which range from simple **artisanal methods** where fish are **placed in plastic bags with an oxygenated atmosphere**, to sophisticated systems which use trucks that filter and recycle the water, and add oxygen and regulate temperature.

Transport: Fish is transported widely in **ships, and by land and air**, and much fish is traded internationally. It is traded live, fresh, frozen, cured and canned. Live, fresh and frozen fish need special care.

Live fish:

- ❖ When live fish are transported, they need oxygen, and the carbon dioxide and ammonia that result from respiration must not be allowed to build up.
- ❖ Most fish transported live are placed in water supersaturated with oxygen (though catfish can breathe air directly through their gills and body skin, and the climbing perch has special air-breathing organs).
- ❖ The fish are often "conditioned" (starved) before they are transported to reduce their metabolism and increase packing density, and the water can be cooled to further reduce metabolism. Live crustaceans can be packed in wet sawdust to keep the air humid.

By air:

- ❖ Over five percent of the global fish production is transported by air.
- ❖ Air transport needs special care in preparation and handling and careful scheduling. **Airline transport hubs** often require cargo transfers under their own tight schedules.
- ❖ This can influence when the product is delivered, and consequently the condition it is in when it is delivered.
- ❖ The air shipment of **leaking seafood packages causes corrosion damage to aircraft**, and each year, in the US, requires millions of dollars to repair the damage.
- ❖ Most **airlines prefer fish that is packed in dry ice or gel, and not packed in ice.**

By land or sea:

- ❖ "The most challenging aspect of fish transportation by sea or by road is the maintenance of the cold chain, for fresh, chilled and frozen products and the optimisation of the packing and stowage density.
- ❖ Maintaining the cold chain requires the use of insulated containers or transport vehicles and adequate quantities of coolants or mechanical refrigeration.
- ❖ Continuous temperature monitors are used to provide evidence that the cold chain has not been broken during transportation.
- ❖ Excellent development in food packaging and handling allow rapid and efficient loading, transport and unloading of fish and fishery products by road or by sea.
- ❖ Also, transport of fish by sea allows for the use of special containers that carry fish under vacuum, modified or controlled atmosphere, combined with refrigeration."

—END—

3. PROCESSING AND PRESERVATION OF FISH

I. SPOILAGE OF FISH

1. Reflective eyes
2. Slimy
3. Firm meat (feels like your muscle)
4. Bright red blood color near to their head.
5. Curved eye
6. Translucent flesh (most species)
7. Smell (fresh fish has mild ocean and fishy smell)

Spoilage and freshness are the two qualities that have to be clearly defined.

Spoilage is caused by the action of enzymes, bacteria and chemicals present in the fish. In addition, the following factors contribute to spoilage of fish.

Process of spoilage

1. Rigor mortis
2. Autolysis
3. Bacterial invasion and putrefaction

Enzyme action

1. Rigor Mortis

- ❖ **The Rigor mortis** is a physical effect on the muscle tissue of fish caused by chemical changes following the death.
- ❖ After the death, the normal circulatory system breaks down and chemical signals leak into the muscle causing them to stiffen.
- ❖ This process is known as **Rigor Mortis**

2. **Autolysis:** After the completion of rigor mortis, muscle stiffness gradually decreases accompanied by increase in pH, ending up in softening of muscle. This is followed by breakdown of proteins by enzymes. This process is called as **autolysis**.

3. **Action of the Bacteria:** The important changes brought out by the action of the bacteria in fish are as follows.

- Reduction of TMAO to TMA:
- Breakdown of Amino Acids and formation of Primary Amines:
- Breakdown in Urea

II. PROCESSING

- ❖ Fish spoils very quickly within 12 hours after being harvested.
- ❖ This due to the high ambient temperature that is ideal for bacterial growth.
- ❖ To prevent contamination of the fish, proper hygiene must be ensured.
- ❖ Contamination can come from people, soil, dust, sewage, surface water, manure, or spoiled foods.
- ❖ Poorly cleaned equipment, domestic animals, pets, vermin or unhygienically slaughtered animals can also be the cause.
- ❖ To prevent spoilage of the harvested fish, either the bacteria present in them must be killed or their growth must be suppressed.

Different methods exist to suppress bacterial growth:

Ancient methods of preserving fish included drying, salting, pickling and smoking. All of these techniques are still used today but the more modern techniques of freezing and canning have taken on a large importance.

Fish curing includes and of **curing fish by drying, salting, smoking, and pickling**, or by combinations of these processes have been employed since ancient times.

Fish to be cured are usually **first cleaned, scaled, and eviscerated**.

Fish are salted by packing them between **layers of salt or by immersion in brine**. The fish most extensively salted are **cod, herring, mackerel, and haddock**.

Smoking preserves fish by drying, by deposition of creosote ingredients, and, when the fish are near the source of heat, by heat penetration. Herring and haddock (finnan haddie) are commonly smoked.

Sardines, pilchards, and anchovies are small fish of the herring family, often **salted and smoked and then preserved in oil**.

Fish are dried under controlled conditions of temperature, humidity, and air velocity. Since the dried product is relatively unappetizing and rehydrating slow, other preservation methods are common.

Salting:

- ❖ This is an inexpensive method when salt is cheap, as no electricity is necessary and storage can be at room temperature.
- ❖ Fish quality and nutritional value are reasonable after salting.
- ❖ Storage life is long.

Drying:

- Inexpensive method as no electricity is required and little equipment is needed.
- Dry and / or airtight storage is required.
- Quality and nutritional value are reasonable if storage is good.

Smoking

- Inexpensive, little equipment and energy needed, but fuel must be available.
- Quality and nutritional value are reasonable.

Fermentation:

- This method is often inexpensive, but the fish taste and odour are radically changed.
- Storage life varies depending on the product.
- Nutritional value is often high.

Canning:

- This is a fairly expensive method. Because, it is labour intensive and requires plenty of energy, water and equipment, such as tins or jars with lids, sterilisers and canning machines.
- Packaging is expensive. Storage is easy and possible for long periods (below 25 °C / 77 °F).
- Quality and nutritional value are good.

Cooling and Freezing:

- ❖ This is a very expensive method.
- ❖ Because, it involves high use of energy and large investments in equipment.
- ❖ Quality and nutritional value of the product are good and storage life is long.
- ❖ Sun drying is the most common processing method practiced in India.
- ❖ It is also the simplest and least expensive way to preserve fish. The steps in drying fresh fish are
 1. Split the fish into butterfly fillets along the backbone with a sharp knife.

2. Remove the gills and internal organs or the entrails.
3. Wash fish to remove all traces of blood.
4. Immerse split fish into a brine solution of 1 part salt to 3 parts water for 30 minutes to 1 hour depending on the size of fish.
5. Drain the fish and dry under the sun for 1 to 2 days.
6. Store dried fish in a cool, dry place.

Smoking of Fish

1. Remove the gills and entrails
2. Wash and soak in brine solution (1:3 salts to water) for 30 minutes to one hour depending on the size of fish.
3. Boil in 10% brine solution (1 part salt to 9 parts water) for 10 to 20 minutes.
4. Smoke for 30 minutes at 43-66°C.
5. Pack in plastic bags and refrigerate.

—END—

4. FISHERY BY-PRODUCTS AND THEIR USE

1. FISH PROTEIN CONCENTRATE

- Fish protein concentrate (FPC) is a stable protein concentrate prepared from whole fish or other aquatic animals or parts thereof.
- Protein concentration is increased by removal of water, oil, bones and other materials

Uses

- Though FPC is intended for human consumption it is not relished for consumption as such.
- It is therefore incorporated as a protein supplement in human diet. 5-10 per cent level FPC in bread and biscuit is considered the acceptable limit.
- 35 g per person per day is a recommended level of use of FPC.

2. GELATIN

- ❖ Gelatin is a protein that lacks in an essential amino acid tryptophan, and hence cannot be considered as a sole source of protein in animal or human nutrition.
- ❖ But it is a relatively high source of lysine and methionine, which are deficient in cereal proteins.
- ❖ **Uses:**
- ❖ Gelatin is used in the food industry as a gelling, stabilising, emulsifying, dispersing or thickening agent.

3. INSULIN

- ❖ Insulin is a hormone used for correcting the condition called diabetes mellitus in humans.
- ❖ Fish insulin is more stable as it is not subjected to decomposition by protein splitting enzymes of pancreas.

4. FISH ALBUMIN

- ❖ Fish albumin is a product similar to egg albumin in physical and chemical properties.
- ❖ It can be processed out of proteinaceous residue from fish scrap or fish waste.
- ❖ Two grades of fish albumin are produced, the technical grade and the food and pharmaceutical grade.

Uses

- ❖ Fish albumin is widely used in food and pharmaceutical products as whipping, suspending or stabilizing agent.
- ❖ Food grade albumin is an additive in ice cream, soup powder, puddings, confectionery, bakery products, mayonnaise, custard powder etc.

5. MINCE-BASED PRODUCTS

- ❖ The fish mince finds application in processing several convenience foods like fish finger, cutlet, burger and also in some low cost salted and dried products.
- ❖ In preparation of fish finger, stick, sake etc., the mince stripped from the bone frame is incorporated to increase the yield.

6. Fish finger

- ❖ Fish finger is a very popular product made out of fish mince.
- ❖ The mince is mixed with 1.0 per cent salt, made into rectangular slabs and frozen.
- ❖ The frozen mince is cut into suitable uniform sizes.
- ❖ These pieces are given a coating of batter followed by breading.
- ❖ The battered and breaded fish fingers are flash-fried in oil maintained at 180-200° C for about 20 seconds. After cooling the fingers are frozen and stored.

7. Fish Burger

- ❖ Burger is made using mince from lean white fleshed fish.
- ❖ Cooked mince is mixed with cooled potato and mild spices and formed into flat round pieces. These are battered, breaded and flash-fried as for fish fingers.

8. Salted Fish Cake

- ❖ The mince is mixed with salt. Salting will denature the protein and reduce its water holding capacity and hence will result in release of water.

- ❖ The fish/salt mix is pressed suitably to release more water. The resultant cake is dried.
- ❖ Several other products like cutlet, fish ball, paste etc. can be processed out of fish mince.

9. Fish flour

- ❖ Fish meal is prepared by solvent extraction process on commercial scale. This can be blended with wheat or maize flour and is used as enriching component in bread, biscuits, cakes, sweets and soups. It forms an ideal protein supplement to human diets.

10. Fish flakes/wafers

- ❖ Thread fin breams and cat fishes are used in the preparation of flakes or wafers.
- ❖ Fish flesh is boiled, mixed with maida, salt, etc. to prepare flakes or wafers.

11. Surimi:

- ❖ Refers to a Japanese food product intended to mimic the meat of lobster, crab, and other shellfish.
- ❖ It is typically made from white-fleshed fish (such as pollock or hake) that has been pulverized to a paste and attains a rubbery texture when cooked.

12. Fish glue

- ❖ It is made by boiling the skin, bones and swim bladders of fish.
- ❖ Fish glue has long been valued for its use in all manner of products from illuminated manuscripts to the Mongolian war bow.

13. Fish oil is recommended for a healthy diet because it contains the omega-3 fatty acids, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), precursors to eicosanoids that reduce inflammation throughout the body.

14. Fish emulsion is a fertilizer emulsion that is produced from the fluid remains of fish processed for fish oil and fish meal industrially.

15. Fish hydrolysate is ground up fish carcasses. After the usable portions are removed for human consumption, the remaining fish body – guts, bones, cartilage, scales, meat, etc. – are put into water and ground up.

16. Fish meal is made from both whole fish and the bones and offal from processed fish. It is a brown powder or cake obtained by rendering pressing the whole fish or fish trimmings to remove the fish oil. It used as a high-protein supplement in aquaculture feed.

17. Fish sauce is a condiment that is derived from fish that have been allowed to ferment. It is an essential ingredient in many curries and sauces.

18. Isinglass is a substance obtained from the swim bladders of fish (especially sturgeon), it is used for the clarification of wine and beer.

19. Tatami iwashi is a Japanese processed food product made from baby sardines laid out and dried while entwined in a single layer to form a large mat-like sheet.

Other byproducts

- ❖ **Pearls, mother-of-pearl**, and abalone are valued for their lustre.
- ❖ Traditional methods of pearl hunting are now virtually extinct.
- ❖ Sea horse, star fish, sea urchin and sea cucumber are used in **traditional Chinese medicine**.
- ❖ The Sea snails *Murex brandaris* and *Murex trunculus* are used to make the pigment **Tyrian purple**.
- ❖ Some **sepia pigment** is made from the inky secretions of **cuttlefish**.
- ❖ **Kelp** is a major source of iodine, can be used as fertilizer, and kelp ash can be used in soap and glass productions.

5. FISH MARKETING AND ECONOMICS

Marketing of Inland fish:

- Inland fishery is carried out at specific locations where water bodies are available.
- Such locations may be in the interior areas and scattered, away from towns and cities where consumer markets exist.
- Fish being highly perishable commodity, its marketing assumes special significance.
- It needs: Good roads and quick transport facilities
- Suitable container, ice, cold storage to keep fish fresh for longer time
- Suitable agency (or agencies) as fishermen are poor, unorganized and cannot reach consumers.
- These facilities are generally not available upto desired expectations and the fishermen face more problems than the fishermen are engaged in marine fishery.
- Because marine fishery is carried out in relatively concentrated or localised area where infrastructure facilities are provided in a better manner.

In Tamil Nadu, entire fish production comes from inland fishery.

- ❖ Average fish production per farm was about 14 Q and per hectare 10.55 Q.
- ❖ This indicated that the average size of farm was 1.32 ha.
- ❖ With average net sale price of Rs. 10 per kg, annual income per farmer came to Rs. 14,000, which was quite small. As regards disposal, 93.5% was sold out as marketed surplus.

❖ **There were four channels of marketing**

Channel I – Producer – Consumer (Local Market)

Channel II – Producer – Consumer (Door to door sale)

Channel III – Producer – Wholesaler – Retailer – Consumer

Channel IV – Producer – Contractor

- ❖ Nearly 26.30% produce was sold in the local market, 8.86% door to door, 36.30% to wholesaler and 28.54% to contractor.
- ❖ Most of the marginal and small farmers sold their produce to contractors only, semi-medium and medium farmers sold to both wholesalers as well as contractors.
- ❖ Only landless and marginal farmers sold their fish door to door.
- ❖ Final prices paid by consumers varied from Rs. 30 to 35 per kg.
- ❖ The marketing was simple and local, not involving much cost.

FISHERY ECONOMICS: The production, distribution, and consumption of fish and seafood and all financial aspects of the **fishing** and seafood industry (including aquatic life in fresh water).

- ❖ The **maximum sustainable yield (MSY)** for a given **fish** stock means the highest possible annual catch that can be sustained over time, by keeping the stock at the level producing maximum growth. The **MSY** refers to a hypothetical equilibrium state between the exploited population and the **fishing** activity.

Economic importance of aquaculture and fishery management.

1. It increases food production, especially of animal proteins, and achieving self-sufficiency in aquatic products supplies.
2. It contributes to improvement of human nutrition.
3. It generates new source of employment in rural areas, including part-time employment of farmers and small-scale fishermen, and arresting the migration of people from rural to urban areas.
4. Earning foreign exchange through export or saving foreign exchange through import substitution.
5. It promotes agro-industrial development, which could include processing and marketing of fishery products, feeds and equipment for aquaculture, and seaweed culture for the production of marine colloids, pearl oyster culture etc.
6. It creates and maintains leisure-time activities, including sport fishing and home and public aquaria.
7. Overall development of rural areas through integrated projects, including aquaculture.

Economics achieve the following objectives

- a. To describe the socio-demographic characteristics of fish farmers in the study area;
- b. To determine the cost, profitability and viability of fish farming;
- c. To determine the factors influencing fish production on the study areas;
- d. To make relevant recommendations based on the findings of the study.

—END—